RISK PROVISION IMPLEMENTATION FOR FINANCIAL PROCESSING IN A RELATIONAL DATABASE MANAGEMENT SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

5   This application is related to the following co-pending and commonly assigned patent applications:

Application Serial No. 09/---,---, entitled "BASIC AND INTERMEDIATE NET INTEREST REVENUE IMPLEMENTATION FOR FINANCIAL PROCESSING IN A RELATIONAL DATABASE MANAGEMENT SYSTEM," filed on same date herewith,

10 by George Robert Hood and Paul Phibbs, attorney's docket number 8980;

Application Serial No. 09/---,---, entitled "ADVANCED AND BREAKTHROUGH NET INTEREST REVENUE IMPLEMENTATION FOR FINANCIAL PROCESSING IN A RELATIONAL DATABASE MANAGEMENT SYSTEM," filed on same date herewith, by George Robert Hood and Paul Phibbs,

15 attorney's docket number 9006;

Application Serial No. 09/---,---, entitled "OTHER REVENUE IMPLEMENTATION FOR FINANCIAL PROCESSING IN A RELATIONAL DATABASE MANAGEMENT SYSTEM," filed on same date herewith, by George Robert Hood, attorney's docket number 9015;

20 Application Serial No. 09/---,---, entitled "DIRECT EXPENSE IMPLEMENTATION FOR FINANCIAL PROCESSING IN A RELATIONAL DATABASE MANAGEMENT SYSTEM," filed on same date herewith, by George Robert Hood, attorney's docket number 9010; and

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Application Serial No. 09/---,---, entitled "INDIRECT EXPENSE

IMPLEMENTATION FOR FINANCIAL PROCESSING IN A RELATIONAL

DATABASE MANAGEMENT SYSTEM," filed on same date herewith, by George Robert

Hood, attorney's docket number 9008;

5   all of which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

1.   Field of the Invention.

This invention relates in general to financial processing systems performed by

10   computers, and in particular, to the implementation of "risk provision" calculations for

financial processing using data accessed from a relational database management system.

2.   Description of Related Art.

Financial processing systems provide tools for financial analysis of accounting data.

15   Typically, each financial processing system operates in a unique way and approaches financial

analysis differently. Some financial processing systems are advanced in their approach to

profitability calculations, and others are still at a more basic level. In addition, there is no

agreement as to the rules for profitability calculations, outside of generally accepted

accounting policies that external auditors use.

20   Yet, the majority of financial processing systems attempt to use profitability

calculations to differentiate between sources of revenues and expenses. There is a need,

then, for a flexible approach to profitability calculations in terms of the overall metric, as

well as the type of data used.

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SUMMARY OF THE INVENTION

A Value Analyzer is a data-driven computer-facilitated financial processing system that accesses account, event and organization attributes from a relational database management database, wherein: (1) the account attributes comprise data about accounts being measured, (2) the event attributes comprise data about account-related transactions, and (3) the organization attributes comprise data about the organization's financial status. Profitability calculations are performed using the account, event and organization attributes accessed from the relational database management system, as well as one or more profit factors and one or more rules. The profitability calculations include the following:

Profit = Net Interest Revenue (NIR)

+ Other Revenue (OR)

- Direct Expense (DE)

- Indirect Expense (IE)

- Risk Provision (RP)

In this calculation, Risk Provision (RP) comprises an expected future loss that arises from one or more risk factors.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

FIG. 1 illustrates an exemplary hardware and software environment according to the preferred embodiment of the present invention;

FIG. 2 is a data flow diagram that illustrates the operation of the Value Analyzer according to the preferred embodiment of the present invention; and

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FIG. 3 is a flow chart illustrating the steps necessary for the execution of Profitability Calculations according to the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5   In the following description of the preferred embodiment, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration a specific embodiment in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

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OVERVIEW

The Value Analyzer is a data-driven computer-facilitated financial model that provides accurate and consistent profitability calculations using account, event and organization data stored in a relational database management system (RDBMS), wherein: (1)

15   the account attributes comprise data about accounts being measured, (2) the event attributes comprise data about account-related transactions, and (3) the organization attributes comprise data about the organization's financial status. The profitability calculations performed by the Value Analyzer rely on a Five Factor Atomic Profit Metric (FFAPM):

Profit   =   Net Interest Revenue (NIR)

20   +   Other Revenue (OR)

            -    Direct Expense (DE)

            -    Indirect Expense (IE)

            -    Risk Provision (RP)

            =   NIR + OR - DE - IE - RP

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In the above equation, it is assumed that the sign of elements that reduce profit are negative and those that contribute are positive.

Each of the five factors of FFAPM are defined below:

- Net Interest Revenue. This component comprises interest revenue, and is the largest component of profitability (e.g., from loans, deposits, cash, etc.).

- Other Revenue. This component comprises non-interest revenue (e.g., fees and commissions), including those driven by events (e.g., open account, excessive counter withdrawals, early payout penalties, etc.).

- Direct Expense. This component comprises expenses driven by events that are attributable to accounts.

- Indirect Expense. This component comprises expenses that are not attributable to specific accounts. This includes expenses that relate to the cost of doing business that are not driven by account or event activity, such as those that arise from overheads, inefficiencies or differences between standard and actual costs (e.g., the CEO's salary, etc.).

- Risk Provision. This component comprises the expected cost of risks that arise from the uncertainties of doing business, e.g., market risks, customer credit, competition, operations, regulatory risks, political risks, etc.

Each of these five factors can be measured for a desired period (daily, weekly, monthly, quarterly, etc.). Moreover, each factor is essentially discrete and independent with fundamentally different characteristics, which strengthens the user's ability to fully utilize the output to determine relationships between account, event and organization data, and enable consistent multiple dimensional aggregation.

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The FFAPM is "atomic" in that profitability is computed using data stored in a relational database management system (RDBMS). There are three aspects to this:

- components of profitability may be measured below the account level (at events which make up account activity over an accounting period) and accumulated to the account,

- components of profitability may be measured directly at the account level (such as interest paid or earned for an accounting period),

- components of profitability may be known, obtained, or aggregated at a higher level, and may be apportioned down to specific accounts and events according to various rules.

The Value Analyzer generally defines "indirect" components of profitability to be those which must be apportioned to accounts and "direct" components to be those which are either computed at the account level, or are rolled up to the account level from lower level events.

HARDWARE AND SOFTWARE ENVIRONMENT

FIG. 1 illustrates an exemplary hardware and software environment according to the preferred embodiment of the present invention. In the exemplary environment, a computer system 100 implements a financial processing system in a three-tier client-server architecture, wherein the first or client tier provides a Value Analyzer Client 102 that may include, inter alia, a graphical user interface (GUI), the second or middle tier provides a Value Analyzer Calculation Engine 104 for performing profitability calculations as described later in this application, and the third or server tier comprises a Relational DataBase Management system

(RDBMS) 106 that stores the data and metadata necessary for performing the profitability

calculations from the data and metadata stored in a relational database. The first, second,

and third tiers may be implemented in separate machines, or may be implemented as

separate or related processes in a single machine.

5   In the preferred embodiment, the Value Analyzer Client 102 and the Value Analyzer

Calculation Engine 104 together are referred to as the Value Analyzer. Generally, the Value

Analyzer Client 102 includes a graphical user interface (GUI) for operators of the system

100, wherein requests are transmitted to the Value Analyzer Calculation Engine 104 and

responses are received therefrom. The Value Analyzer Calculation Engine 104 performs the

10   profitability calculations and other processing, including commands or functions for

performing various search and retrieval functions in the RDBMS 106, wherein queries are

transmitted to the RDBMS 106 as requests and tuples are received therefrom as responses.

The Value Analyzer Client 102 and the Value Analyzer Calculation Engine 104 may be

implemented in separate machines, or may be implemented as separate or related processes

15   in a single machine.

In the preferred embodiment, the RDBMS 106 includes at least one Parsing Engine

(PE) 108 and one or more Access Module Processors (AMPs) 110A-110E storing the

relational database in one or more data storage devices 112A-112E. The Parsing Engine 108

and Access Module Processors 110 may be implemented in separate machines, or may be

20   implemented as separate or related processes in a single machine. The RDBMS 106 used in

the preferred embodiment comprises the Teradata® RDBMS sold by NCR Corporation, the

assignee of the present invention, although other DBMS's could be used.

In the preferred embodiment, the system 100 may use any number of different

parallelism mechanisms to take advantage of the parallelism offered by multiple Access

Module Processors 110. Further, data within the relational database may be fully partitioned across all data storage devices 112 in the system 100 using hash partitioning or other partitioning methods.

Generally, the Value Analyzer Client 102, Value Analyzer Calculation Engine 104,

5   RDBMS 106, Parsing Engine 108, and/or Access Module Processors 110A-110E comprise logic and/or data tangibly embodied in and/or accessible from a device, media, carrier, or signal, such as RAM, ROM, one or more of the data storage devices 112A-112E, and/or a remote system or device communicating with the computer system 100 via one or more data communications devices.

10   However, those skilled in the art will recognize that the exemplary environment illustrated in FIG. 1 is not intended to limit the present invention. Indeed, those skilled in the art will recognize that other alternative environments may be used without departing from the scope of the present invention. In addition, it should be understood that the present invention may also apply to components other than those disclosed herein.

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VALUE ANALYZER DATA FLOW

FIG. 2 is a data flow diagram that illustrates the operation of the Value Analyzer Calculation Engine 104 according to the preferred embodiment of the present invention. Within the Value Analyzer Calculation Engine 104, one or more Profitability Calculations

20   200 accept a number of inputs including Account Attributes 202, Event Attributes 204, Organization Attributes 206, and Profit Factors 208. Thereafter, the Profitability Calculations 200 invoke one or more Rules 210 that generate the FFAPM 212, which in turn are used to create the Database 212. The Database 212 may be represented along account,

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event, or organization dimensions, or along other dimensions as may be required. These elements are described in more detail below.

Input Definitions

5   Account Attributes 202 comprise data about the accounts being measured. This data includes: balance, rate (or interest accrued), product identification, limits, expected default frequency, and various dates (e.g., open, rate reset, last payment, next payment, maturity, etc.).

Event Attributes 204 comprise data about account-related events or transactions.

10   This data includes: account identification, event or transaction amounts, event or transaction location, event or transaction time, counter-party identification, event or transaction type (e.g., loan payment, interest paid, loan draw down amount, etc.).

Organization Attributes 206 comprise data about the financial status of the organization. This data includes: balance sheet and profit statement amounts aggregated by

15   the legal or management entities that own the account base being measured.

Profit Factors 208 include parameter values necessary to perform the Profitability Calculations 200. The major classifications of this data include:

- Funds transfer rates are pricing methods that require matched maturity opportunity rates for use in valuing each account's marginal use or source of

20   internal funds.

- Unit costs are used for Direct Expense calculations, where a total cost is provided as an Organization Attribute 206 and the unit costs are then derived by dividing the total cost by actual event volume. Unit costs can be

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either standard, actual, or market, and ideally represent marginal values (if "fully absorbed measures" are used, then the usefulness of allocated amounts is diminished.)

- Allocated amounts are used in both Other Revenue and Indirect Expense calculations, wherein the allocated amounts are apportioned amongst all accounts in a group.

- Miscellaneous calculation values may comprise, for example, the number of days in a profit measurement period, an equity allocation weighting, etc. These values are known as "modeling" parameters.

- Amortization parameters are used in interest amortization, which requires interest rates and life values used by straight line amortization and by declining balance of amortization.

- Risk measurement parameters are used in Risk Provision calculations, which require various factors, such as: loss rates, reserve percentages, exposure factors, recovery rates, default probabilities and collection costs.

- Tax rates are required for after-tax profit calculation. The Value Analyzer is designed to calculate pre-tax income on a taxable equivalent basis (where an effective tax rate is all that is required to transform pre-tax income into after tax earnings, i.e., Profit).

Rules

The Profitability Calculations 200 use one or more Rules 210 applied to data retrieved from the RDBMS 106. These Rules 210 include, inter alia, the following:

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Treatments. Every account with cash flows affecting a organization's balance sheet requires a method of valuing the account's use of internal funds. One approach is "matched maturity funds transfer pricing," which uses a canonical representation of an account's funding characteristics and then determines a value based on adjusted market yields for each
5   instance that requires an interest rate transfer price to calculate an account's marginal Net Interest Revenue.

Equity Allocation. In order to provide precise Net Interest Revenue calculations, the amount of equity funds required at an account must be determined. This rule allows for equity allocation using any of the following methods: simple ratios; regulatory definitions;
10   economic allocations, or user defined allocations.

Apportionment. Other Revenue, Risk Provision and Indirect Expense calculations are applied at the account level using Organization Attributes 206 that are not related directly to account activity. These profit adjustments are made so that the sum of all account-level Profitability Calculations 200 comprises the overall profit. One approach is to pool indirect
15   costs and revenues and then apportion them. Apportionment rules specify how the pooled indirect costs and revenues is completely allocated to appropriate accounts, wherein the preferred embodiment uses closed form rules, which require only information known in the current period and not iterative computation.

Amortization. Some types of income or expense are deferred or accrued over
20   multiple periods, including and subsequent to the current accounting period. This is common to accrual accounting methods used in profit presentations of financial statements, and gives rise to timing differences between cash flows and their related profit as presented in a financial statement in any accounting period. Since the Value Analyzer is designed to reconcile to the financial statement's profit values, it supports deferral and accrual

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accounting principles. Amortization methods that account for these timing differences are: interest amortization (used for interest income and expense accruals and for deferral of fees that are in lieu of interest), and straight line or declining balance amortizations (used for cost deferrals and investment depreciation).

5   Other Revenue Pricing. In situations where account and event activity can be used to derive account level income or fees, the Value Analyzer calculates these drivers of the profitability in the Other Revenue calculations. These calculations comprise linear combinations of event or account values and modeled coefficients.

   Direct Expense. The calculation of account profit adjustments due to account-
10 related activity requires rules that take the form of linear combinations of event or account values and modeled coefficients.

   Indirect Expense. In situations where expense apportionment or amortization amounts are aggregated, the user may want different rules applied depending on the path (or dimension) of aggregation. These rules allow for multiple profit calculations rules to be
15 applied to derive multiple account level Indirect Expense amounts.

   Risk Provision. Adjusting current profit for expected future losses is known as "actuarial" profit provisioning. The Value Analyzer applies actuarial-based methods in its account level profit calculations, where the actuarial reserve that the provisions maintain represents the expected loss associated with all accounts.

20   Taxable Equivalent Gross-up. Profit is an after-tax measure, and thus some events or portions of some accounts' profits may be excluded from normal taxation. The Value Analyzer adjusts these pre-tax values, so that a singular tax rate can be used to convert pre-tax profit into after-tax values, which are also known as taxable equivalent adjustment.

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These rules use account and event attributes to adjust each of the five factors of the FFAPM to a taxable equivalent basis.

Interest Yield Adjustments. Since the Value Analyzer can calculate profits for any number of periods, the adjustment of cash interest payments, and the financial statement's

5   accrual or smoothed representation of interest-related Profit, The Value Analyzer provides a method for converting cash interest amounts to accrual amounts for financial statements. The Value Analyzer implements an "effective interest rate" conversion to accomplish this type of calculation.

10   Profitability Calculations

The following describes the method used by the Profit Calculations 200:

1.   Retrieve data from the RDBMS 106.

2.   Calculate Net Interest Revenue for every account.

3.   Calculate Other Revenue for every account.

15   4.   Calculate Direct Expense for every account.

5.   Calculate Indirect Expense for every account.

6.   Calculate Risk Provision for every account.

7.   Calculate Profit for every account.

8.   Store the FFAPM Profit and the five factors of FFAPM into the RDBMS

20   106.

9.   Aggregate and/or re-calculate the FFAPM Profit and the five factors of FFAPM as necessary.

Note that steps 2 through 6 perform account-level calculations. Steps 2, 3, 4, 5, and 6 can be performed independently and in parallel, while step 7 requires values derived in

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steps 2, 3, 4, 5, and 6, and therefore must be performed after steps 2, 3, 4, 5, and 6 are completed.

Output Definition

5   The Profit Calculations 200 generate one or more values for the five factors of the FFAPM 210, and specifically, the NIR, OR, DE, IE, RP, and Profit values. These values are used to generate the output data 214, which can be stored by the RDBMS 106 in the relational database.

Analytic Variations

10   The Value Analyzer operates on data and calculations across a continuum, in order to provide the analytic variations necessary for financial processing at various levels of aggregation. This continuum is comprised of multiple tiers as described below:

basic - >intermediate - >advanced - >breakthrough.

15   Not every tier is necessarily present for each element of data or every calculation.

This continuum embodies the notion of inheritance, wherein the data and calculations of the higher tiers embody the data and calculations of the lower tiers. The principle of inheritance means that the data and calculations by which the separate tiers are defined are nested, i.e., the definition of "intermediate" includes the definition of "basic,"

20   but with added functionality that goes beyond "basic," and so on. Thus, there is consistency in the data and calculations performed at the different tiers in the continuum.

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<u>Risk Provision</u>

As noted above, the Risk Provision (RP) factor of FFAPM focuses on providing a component of profitability related to risk factors of the organization. There are numerous forms of risk in any business, such as market risk, customer risk, operational risk,

5   competitive risk, political risk, regulatory risk, etc. Risk cannot be eliminated by the organization, but exposure can be controlled; and the first step in risk control is developing a risk measurement process.

In the Value Analyzer, this measurement process requires the separation of expected profit outcomes from the uncertainty of this estimate. The Value Analyzer, therefore,

10   includes the expected cost of risk, or "Risk Provision," in the FFAPM. As experience with the Value Analyzer builds over time, statistical time series methods can be applied to historical profit data to study and measure risk behavior using the Risk Provision to adjust the Profit for expected outcomes and hedging costs.

The Value Analyzer focuses on ensuring that the organization is able to provide

15   adequately for predicted losses at an account level, which enables sophisticated risk management and provides a better reflection of the organization's profitability. This approach to provisioning is consistent with the "Credit Metrics" approach found in current risk management literature.

A simple model for understanding the basic dynamics of Risk Provision on the

20   Profitability Calculations 200 follows. Suppose the organization has reserves committed to cover possible future loss; for example, loan loss reserves for various loans. As transactions occur, an allowance is made to fund or provision these reserves, and on occasion of default, there will be withdrawals from the reserves to repay them. The provisioning is smooth and in small amounts, at the rate of new product sales. On the other hand, funding is sudden,

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unscheduled (though not unexpected), and typically large, so that the reserve pool varies over time.

There are three variables to consider: the rate of provisioning (inflow), the rate of losses (outflow), and the mean volume of reserves over time. It can be assumed that these

5   factors are in balance. The organization appropriately plans for adequate provisioning to cover expected losses. In particular, then, the flows during the period are related:

Ending Loss Reserves = Beginning Loss Reserves

$-$ Losses

10    $+$ Recoveries

$+$ Risk Provisions

Calculation of the effects of Risk Provision on Profit requires some common inputs, namely a grouping of accounts into risk groups RPG_i, wherein each account

15   is in only one group. Each of these groups have a Risk Provision amount associated therewith, which either is entered by the organization (along with identifying to which group each account belongs) or is calculated by the Value Analyzer from reserves associated with RPG_i, which are supplied for each period instead.

The following shows the calculation of the Risk Provision from known reserve

20   amounts:

$$\text{RP amount for group } RPG_i = \text{Reserve amount for } RPG_i \text{ at end of this period}$$

$$- \text{Reserve amount for } RPG_i \text{ at end of last period}$$

$$+ \text{Losses during this period}$$

$$- \text{Recoveries during this period}$$

Risk Provision in the Basic Tier

Following are the inputs and outputs of the calculation of Risk Provision in the Basic Tier:

Inputs	Outputs
Groups RPG_i of accounts based on product	Risk Provision for each account type
Risk Provision amount associated with each RPG_i, the total of which is the total RP to be allocated	
Rule to determine to which RPG_i each account is assigned, e.g., a rule associating an account type with each group.	

Risk Provision in the Basic Tier comprises an expected loss that is apportioned to accounts, e.g., by account balance percentage. For example, the expected loss on credit cards issued by the organization may equal $1,000,000. Therefore, each credit card account would receive the following allocation:

$$\frac{\$1m * Account\ Balance}{Total\ Card\ Portfolio\ Balance}$$

At the Basic level, the groups RPG_i are determined by the product type. The RP for each group is given by the organization. The apportionment of Risk Provision amounts to each account in the group is based on the balance of the account. Consequently, the formula for calculating RP of $Account_i$ is provided below:

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$$RP(a_i) + RP \text{ amount for } RPG(a_i) * \frac{Balance \text{ of } a_i}{\sum_k^{a_k \in RPG(a_i)} Balance \text{ } a_k}$$

wherein RPG(a_i) denotes to which RPG the account a_i is assigned.

Clearly, the sum of RP(a_i) for all a_i in one group is equal to the RP for the group, by this definition. Note also that the sum of the RP amounts for all groups equals the sum of

5   the RP amounts for all accounts, since all the RP is apportioned to the accounts.

Thus:

$$\sum_i RP \text{ amount for } RPG_i = \sum_i RP \text{ amount for } Account_i$$

Risk Provision in the Intermediate Tier

10   Following are the inputs and outputs of the calculation of Risk Provision in the

Intermediate Tier:

Inputs	Outputs
Groups RPG_i of accounts based on product.	Risk Provision for each account type.
Risk Provision amount associated with each RPG_i, the total of which is the total RP to be allocated.	
Rule to determine in which RPG each account is assigned, e.g., a rule associating an account type with each group.	
Credit Risk Factor (CRF) for each account a_i (preferably a non-negative value that increases with the risk of the account).	

Risk Provision in the Intermediate Tier may comprise an account-level risk factor

15   (defined by the organization) that is used to weight the account balances. This allows the

user to change the Risk Provision based on the risk factor of the account.

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For example:

$$\left(\frac{\$1m * Account\ Balance}{Total\ Card\ Balance} \right) * Risk\ Factor$$

In the Intermediate Tier, the apportionment of the Risk Provision amount in each group is similar to the calculation shown for the Basic Tier, with the additional multiplication

5   by the Credit Risk Factor (CRF).

The Credit Risk Factor (CRF) is designed to identify costs associated with expected losses that arise in lending activities. There is no certainty or guarantee that when funds are lent to the retail market that the terms of the contract will be met and that full principal repayment will be made, and, moreover, the exposure is significantly large. For example,

10   banks today expect to lose in excess of 3% of the total outstanding credit card portfolio over the next 12 months due to failure of credit card customers to repay this unsecured debt.

Consequently, the formula for calculating RP of a_i is as follows, using the same symbols as above, wherein $CRF(a_i)$ denotes the Credit Risk Factor (CRF) for account a_i, is provided by the following:

15   $$RP\ for\ a_i = RP\ amount\ for\ RPG(a_i) * \frac{Balance(a_i) * CRF(a_i)}{\sum\limits_{k}^{a_k \in RPG(a_i)} \left[Balance(a_k) * CRF(a_k) \right]}$$

Note that the purpose of the CRF is to adjust the Risk Provision for such factors as days past due or other conditions that are subordinate to the Risk Provision Groups.

Risk Provision in the Advanced Tier

20   Following are the inputs and outputs of the calculation of Risk Provision in the Advanced Tier:

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Inputs	Outputs
Rule based on account features, balance, and credit limit which supplies an Exposure Amount given the account.	Risk Provision for each account.
Customer Default Probability CDP(a) function for account a that generates a value between 0 and 1 based on the propensity to default.	
Realizable Collateral Value (RCV) on default for the account a.	
For groups of accounts where the organization chooses to use an apportionment approach, the same inputs as the Intermediate Tier are required.	

Risk Provision in the Advanced Tier may comprise an expected loss calculated for each account (rather than apportioned) using account, product, and customer characteristics.

5   In this tier, the expected loss apportionment, which adjusts for varying risk and exposure by account, comprises the following:

$$Expected\ Loss\ Allocation = \frac{Default\ Exposure\ Security}{(Customer)\,(Account)\,(Account)}$$

In the Advanced Tier, the exposure amount allows the direct calculation of the Risk Provision, wherein the exposure amount is typically provided as a rule. For example, a rule

10   might be:

$$Exposure = Max\ (Balance\ Due,\ Limit)\ *\ Factor$$

where the factor may be set, e.g., to 1.1, which is adjusted to cover administrative

15   costs and the cost of delay in identifying when default conditions or limit overruns occur.

Note that this may require data that may not be available at the account level, such as credit limits and collateral or security.

This task is complicated by the use of groups of accounts having a common credit limit or having common collateral. For example, it is usual for banks to have "pseudo-

5   accounts" or consolidation accounts for this purpose. Rules must apportion these amounts to the account level.

The Value Analyzer also allows the use of apportionment for any class of accounts, as described in the Intermediate Tier. For accounts where the organization chooses to compute exposure, the formula for calculating RP of account "a" is as follows, where the

10   Customer Default Probability CDP(a₁) is a probability function of credit risk default frequency:

$$RP(a_i) = Exposure(a_i) * CDP(a_i) * \left(1 - \min\left(1, \frac{RCV(a_i)}{Balance(a_i) + Collection\ Cost(a_i)}\right)\right)$$

Note that the function is positive and ranges between 0 and 1, thereby mirroring the account-holder's propensity to default. The organization must provide this variable.

15   For accounts where the apportionment method of the Intermediate Tier is used, the formula is the same as described there:

$$RP\ for\ a_i = RP\ amount\ for\ RPG(a_i) * \frac{Balance(a_i) * CRF(a_i)}{\sum_{k}^{a_k \in RPG(a_i)} [Balance(a_k) * CRF(a_k)]}$$

It is noted that careful reconciliation is required for this approach, since the first formula is determining Risk Provision amounts rather than starting with a given amount and

20   apportioning it.

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LOGIC OF THE PREFERRED EMBODIMENT

FIG. 3 is a flow chart illustrating the steps necessary for the execution of Profitability Calculations 200 according to the preferred embodiment of the present invention. Those skilled in the art will recognize that this logic is provided for illustrative purposes only and

5   that different logic may be used to accomplish the same results.

Block 300 represents the Value Analyzer Client 102 invoking one or more Profitability Calculations 200 in the Value Analyzer Calculation Engine 104.

Block 302 represents the Value Analyzer Calculation Engine 104 invoking one or more scripts related to the invoked Profitability Calculations 200, wherein the scripts

10   comprise SQL statements that are transmitted to the RDBMS 106. These SQL statements access account, event and organization attributes from the database managed by the RDBMS 106.

Block 304 represents the Parsing Engine 108 of the RDBMS 106 receiving the SQL statements and transforming the statements into an operator tree.

15   Block 306 represents the Parsing Engine 108 of the RDBMS 106 generating one or more access plans from the operator tree.

Block 308 represents the Parsing Engine 108 of the RDBMS 106 parallelizing the access plans, and then transmitting the access plans to their assigned Access Module Processors 110A-E of the RDBMS 106.

20   Block 310 represents the Access Module Processors 110A-E of the RDBMS 106 performing the required data manipulation associated with the access plans received from the Parsing Engine 108, wherein the access plans are performed in parallel by the Access Module Processors 110A-E.

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Block 312 represents the Parsing Engine 108 of the RDBMS 106 merging the results received from the Access Module Processors 110A-E and providing the merged results to the Value Analyzer Calculation Engine 104 as account, event and organization attributes.

Block 314 represents the Value Analyzer Calculation Engine 104 performing the invoked Profitability Calculations 200 using the account, event and organization attributes accessed from the RDBMS 106, as well as one or more profit factors and one or more rules. In this Block, the Profitability Calculations 200 include:

Profit $=$ Net Interest Revenue (NIR)

$+$ Other Revenue (OR)

$-$ Direct Expense (DE)

$-$ Indirect Expense (IE)

$-$ Risk Provision (RP)

wherein the Risk Provision comprises an expected future loss that arises from one or more risk factors selected from a group comprising loss rates, reserve percentages, exposure factors, recovery rates, default probabilities, and collection costs. Moreover, the rules apportion the Risk Provision among the accounts. Consequently, the Risk Provision may predict the expected future losses at the account level, the Risk Provision may apportion the expected future loss among the accounts, and/or the Risk Provision may adjust the Profit for the expected future losses.

Block 316 represents the Value Analyzer Calculation Engine 104 delivering the output or results from the invoked Profitability Calculations 200 to the Value Analyzer Client 102 and/or the RDBMS 106. With regard to the Value Analyzer Client 102, the results may be presented to the user, printed, or used by various other computer programs,

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as desired. With regard to the RDBMS 106, the results may be stored for later use by the Value Analyzer Calculation Engine 104, or other computer programs, as desired.

CONCLUSION

5   This concludes the description of the preferred embodiment of the invention. The following paragraphs describe some alternative embodiments for accomplishing the same invention.

In one alternative embodiment, any type of computer or configuration of computers could be used to implement the present invention. In addition, any database management

10   system, decision support system, on-line analytic processing system, or other computer program that performs similar functions could be used with the present invention.

In summary, the present invention discloses a Value Analyzer, which is a data-driven computer-facilitated financial processing system that accesses account, event and organization attributes from a relational database management database, wherein: (1) the

15   account attributes comprise data about accounts being measured, (2) the event attributes comprise data about account-related transactions, and (3) the organization attributes comprise data about the organization's financial status. Profitability calculations are performed using the account, event and organization attributes accessed from the relational database management system, as well as one or more profit factors and one or more rules.

20   The profitability calculations include the following:

$$\text{Profit} = \text{Net Interest Revenue (NIR)}$$
$$+ \quad \text{Other Revenue (OR)}$$
$$- \quad \text{Direct Expense (DE)}$$
$$- \quad \text{Indirect Expense (IE)}$$

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-    Risk Provision (RP)

In this calculation, the Risk Provision comprises an expected future loss that arises from one or more risk factors.

The foregoing description of the preferred embodiment of the invention has been

5   presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.